



## RX3361 Low Power IF Receiver IC

### Advance Information

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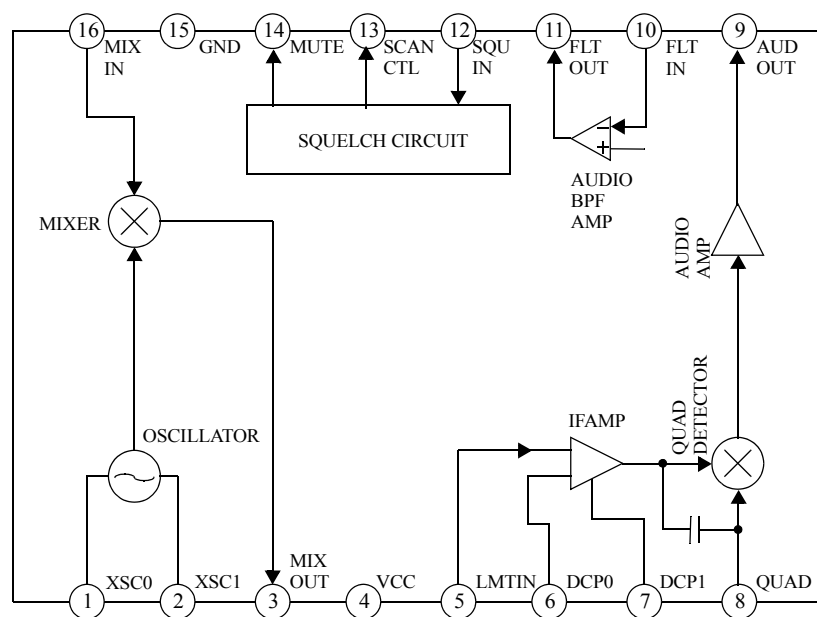
### Description

The RX3361 is a low power IF receiver IC which is fully compatible with the Motorola MC3361C IC and is suitable for use as the second IF downconverter in double conversion receiver systems. The RX3361 is well-suited for wireless FM applications and incorporates a quadrature FM demodulator, on-chip audio filter, and a squelch/mute circuit.

### Features

- ◆ Supply voltage range: 2 to 6 V
- ◆ Built-in crystal oscillator for mixer local oscillator
- ◆ Mixer input frequency: 10 — 50 MHz
- ◆ Quadrature detector
- ◆ On-chip audio filter
- ◆ Audio output
- ◆ SOP-16 package (150 mil pitch)

### Block Diagram





## Pin Descriptions

Number	Name	Description
1	XSC0	Oscillator input (base)
2	XSC1	Oscillator output (emitter)
3	MIXOUT	Mixer output (1.8 K $\Omega$ output impedance)
4	VCC	Nominal 4 V supply
5	LMTIN	IF amplifier input (1.8 K $\Omega$ input impedance)
6	DCP0	IF amplifier de-coupling capacitor connection
7	DCP1	IF amplifier de-coupling capacitor connection
8	QUAD	Quadrature FM demodulator input
9	AUDOUT	Quadrature FM demodulator output
10	FLTIN	Audio bandpass filter input
11	FLTOUT	Audio bandpass filter output
12	SQUIN	Squelch circuit input
13	SCANCTL	Scan control output for LO. Output is high when squelch circuit input level is low.
14	MUTE	Mute output. Impedance to ground is low when squelch circuit input level is low.
15	GND	Ground
16	MIXIN	Mixer input (3.3 K $\Omega$ input impedance)



## Absolute Maximum Ratings

$V_{SS} = 0\text{ V}$

Parameter	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	$V_{SS} - 0.3$ to $V_{SS} + 8.0$	V
Operating temperature range	$T_{OPR}$	-30 to 70	°C
Storage temperature range	$T_{STG}$	-65 to 150	°C
Soldering temperature range	$T_{SLD}$	255	°C
Soldering time range	$t_{SLD}$	10	s

## Recommended Operating Conditions

$V_{SS} = 0\text{ V}$

Parameter	Symbol	Value			Unit
		min.	typ.	max.	
Supply voltage range	$V_{CC1}$	2	4	6	V
MIXIN input frequency	$f_{MIXIN}$		10.7		MHz
Operating temperature	$T_A$	-30	25	70	°C



## Electrical Characteristics

( $V_{CC} = 4.0\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_A = 25\text{ }^\circ\text{C}$ ,  $f_o = 10.7\text{ MHz}$ , unless otherwise noted)

Parameter	Symbol	Condition	Value			Unit
			min.	typ.	max.	
Quiescent current consumption Unmuted Muted	$I_{cc,unm}$ $I_{cc,mut}$	$V(\text{pin}12) = 1\text{ V}$ $V(\text{pin}12) = 0\text{ V}$		2.8 4.2		mA
Audio output voltage	$V_{aud}$	On pin 9 with 10 mV rms in.	130	170	210	mV <sub>rms</sub>
Input Limiting Voltage	$V_{lim3dB}$	On pin 16		2.6	6	$\mu\text{V}$
Total Harmonic Distortion	THD	On pin 9		0.86		%
Recovered Output Voltage	$V_{rec}$	On pin 9	60	190	350	mV <sub>rms</sub>
Audio output impedance	$Z_{det,out}$	On pin 9		450		$\Omega$
Filter Amplifier Gain	$G_{filt}$	On pin 11, with 10 KHz 0.3 mV rms signal input to pin 10.	40	50		dB
Filter Amplifier dc Output voltage	$V_{filt}$	On Pin 11, measured with no audio input.	0.5	0.7	0.9	V
Mute pin resistance Unmuted Muted	$R_{unm}$ $R_{mut}$	From Pin 14 to ground. $V(\text{pin}12) = 1\text{ V}$ $V(\text{pin}12) = 0\text{ V}$	1	30 11	50	$\Omega$ M $\Omega$
Scan control output level Unmuted Muted	$V_{SC,unm}$ $V_{SC,mut}$	Measured on pin 13. $V(\text{pin}12) = 1\text{ V}$ $V(\text{pin}12) = 0\text{ V}$	3.0	0 3.9	0.4	V
Squelch Circuit Hysteresis	$V_{hys}$	Referred to pin 12		45	100	mV
Mixer Conversion Gain	$G_{mix}$	From pin 16 to pin 3		28		dB
Mixer Input Resistance	$R_{mix,in}$	On pin 16		3.3		K $\Omega$
Mixer Input Capacitance	$C_{mix,in}$	On pin 16		9.0		pF



## Functional Description

The RX3361 IF receiver IC incorporates a mixer, crystal-based local oscillator, IF amplifier, quadrature FM demodulator, audio filter, and a squelch circuit and is capable of demodulating FM input signals.

### Mixer

The mixer provides frequency downconversion from the 1st IF input on pin 16 down to the 455 KHz 2nd IF output on pin 3. The external 2nd IF filter should be chosen so that the specified output impedance on the mixer output port is an acceptable termination for the filter.

### Crystal Oscillator

A single dc/dc coupled transistor is available as a two port gain element (pins 1 & 2) to implement a crystal oscillator. The device is biased on-chip to a constant dc current.

### IF Amplifier

The IF Limiter amplifies and limits the pin 5 input from the external 2nd IF filter. The output is a square wave that drives the following demodulator stage. Two off-chip decoupling capacitors to Vcc are required on pins 6 & 7 to remove dc content from the limiter input.

### FM Demodulator

The demodulator provides an audio output generated by multiplying the input IF from the limiter with a quadrature version of the input. The quadrature version is generated by the combination of an on-chip 10pF series capacitor with an off-chip shunt LCR resonator connected between pin 8 and Vcc. Biasing for the input transistor on pin 8 comes from the off-chip resonator. The shape of the demodulator S-curve is determined by the shunt resistance on this LCR resonator. An off-chip RC low pass filter should be used on pin 9 for removal of the 2nd IF components.

### Filter Amplifier

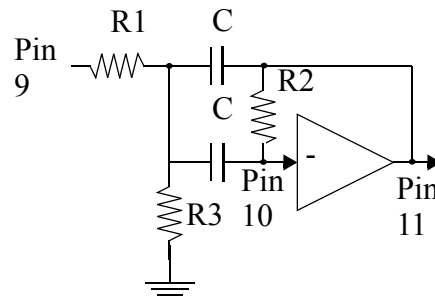
The filter amplifier provides an inverting gain element between pins 10 & 11 for the implementation of an audio filter. Typically, a bandpass Delyiannis-Friend active filter is built by adding externally at least two resistors and two capacitors to this amplifier. An external dc path must be provided through the feedback network across these pins to set the dc operating point. The design equations are as follows:

$$R_1 = \frac{R_2}{2A_o} \qquad R_2 = \frac{1}{(2Q)^2} \cdot \left( \frac{R_1 \cdot R_2}{R_1 - R_2} \right) \qquad R_3 = \frac{Q}{\pi(f_o \cdot C)}$$

where:

$f_o$  is the desired center frequency,  $Q$  is the quality factor,  $A_o$  is the voltage gain at band cen-

ter,  $R_2$  is the feedback resistance,  $C$  is the value for both capacitors,  $R_1$  the series input resistance and  $R_2$  the shunt resistance.



### Squelch Circuit

The squelch circuit provides a means of quieting the audio output when the squelch in signal (pin 12) is lower than the threshold voltage. This is achieved by dropping the impedance on the mute output (pin 14), which typically is connected to the audio output. In addition a scan control output (pin 13) will go high. This output can be used to signal the local oscillator of the first mixer (not included on this chip) to scan to the next frequency.

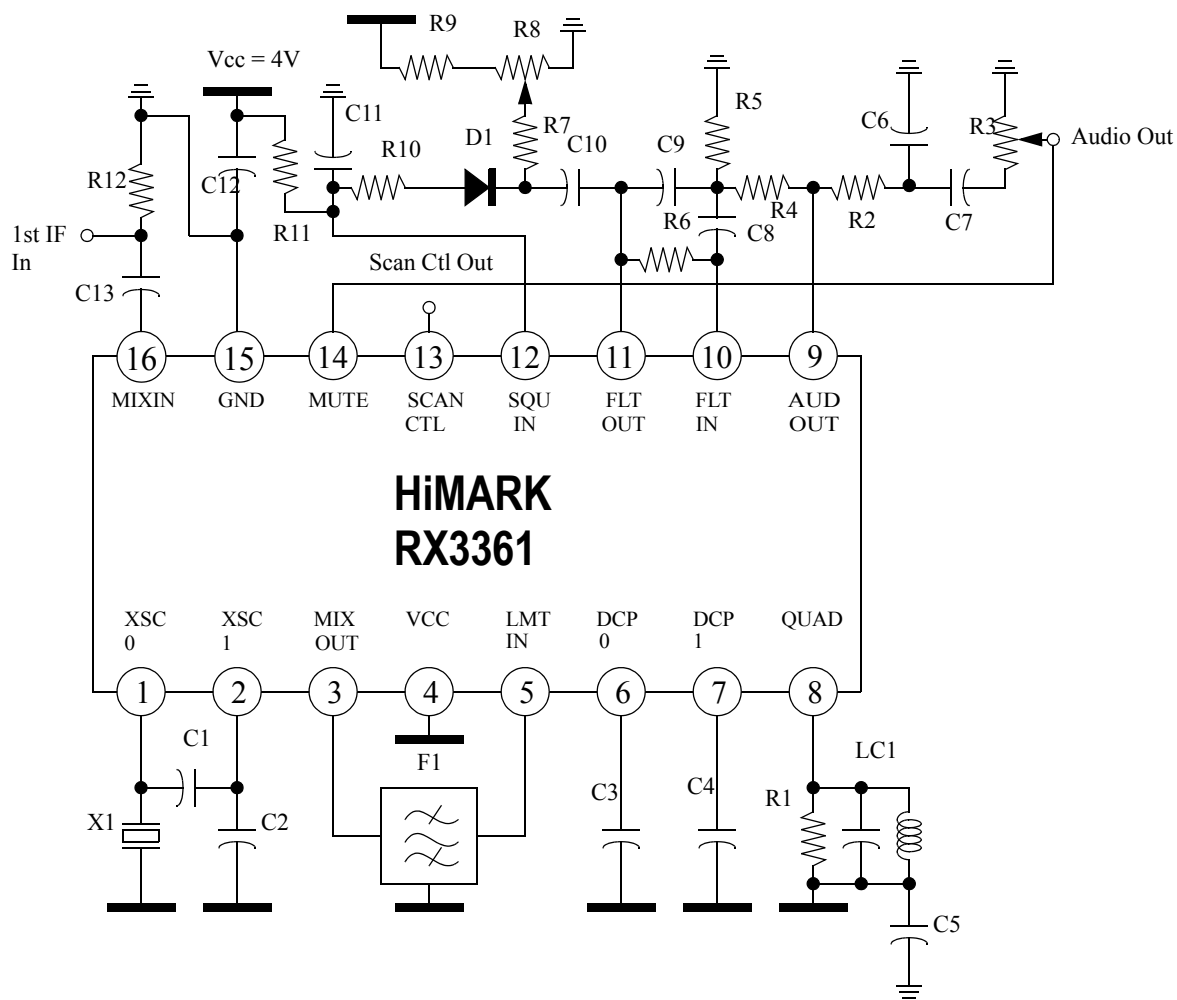
The squelch input signal is provided by external rectification of the audio bandpass output. It is the responsibility of the user to determine the appropriateness of the squelch input polarity. The polarity can be selected by connecting the peak detector to the ground or Vcc side.

A hysteresis voltage is built into the squelch comparator to provide immunity from residual noise and IF components emerging from the bandpass.



RX3361

### Application Circuit



C1	68p	C9	1n	R1	10 KΩ	R9	18 KΩ
C2	220p	C10	0.1μ	R2	3.3 KΩ	R10	1.0 KΩ
C3	0.1μ	C11	4.7μ	R3	10 KΩ pot	R11	100 KΩ
C4	0.1μ	C12	10μ	R4	6.8 KΩ	R12	51Ω
C5	0.1μ	C13	10n	R5	3.3 KΩ	X1	10.245 MHz
C6	22n	D1	1n4148	R6	470 KΩ		
C7	47n	F1	CFU455D2	R7	4.7 KΩ		
C8	1n	LC1		R8	10 KΩ		



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### Revision History

Date	Version Number	Author	Comments
3/17/2002	NC	J. Lin	Original document
3/21/2002	A1	E. Lin	Minor cosmetic corrections. Unified document format.